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ESTIMATING THE EFFECT OF PERSONAL INCOME TAX ON LABOUR SUPPLY IN ITALY

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Abstract

In this paper we attempt to estimate labour supply elasticities for four categories of Italian workers: married men, married women, unmarried men, unmarried women. We use microdata provided by the Bank of Italy 2002 survey adopting a piecewise linear labour supply functional form. Sample selection and tobit technique have been used. Wage elasticities are calculated from the results of the labour supply estimation. Hours of work are found to be positively related to after tax labour income and negatively related to virtual income. Female labour supply is more sensitive than that of males to an increase in net wage.

1. Introduction[*]

OECD statistics shows that in Italy, in 2004, every worker worked a mean of 1,585 hours, against 1,824 hours in the US, 1,669 in the United Kingdom, that is two countries with an incidence of taxes lower than Italy. Economic theory usually attributes the low labour supply and labour force participation to the joint effect of high marginal tax rates and social security systems. For instance, Prescott (2004) argues that the large differences between U.S. labour supply and those of Germany and France are due to difference in tax systems. But on the other hand, countries with high taxation also show a number of hours worked higher than or equal to Italy: for instance Finland (1,736 hours worked) or Sweden (1,585).[1] This factor lead to think that other variables may affect labour supply. For instance, Alesina et al. (2005), examine the role played by trade unions: they find that impact of taxes on labour supply disappears if the model control for unionisation or labour market regulation.

Moreover, Italy currently shows one of the lowest labour force participation rate in the EU. Overall Italian employment rate in the age class 15-64 was 57.6 per cent in 2004, against 63 per cent in EU-25. The female employment rate is 45.2 (55 per cent in EU-25). The activity rate in Italy is also smaller than the European average: 62.7 per cent in the age class 15-64,

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[*] I would like to thank Pawel Strawiński and an anonymous referee for helpful comments. Obviously I bear full responsibility for any remaining errors.

[1] Data Source: OECD (2006).

against 69.7 per cent (EU-25) and 70.6 per cent (EU-15). For women the percentage is 50.6 against 62.0 and 62.6 per cent respectively.[2]

These figures indicates that even if it is undoubted that labour supply does respond to taxes and social security system, it is also important to observe the nature of the labour supply response. Eissa and Hoynes (2005), investigating the relationship between the American Earned Income Tax Credit (EITC) and labour supply, find that the program encourage the employment (especially that of categories such as single parents, especially mothers) but reduces the hours worked by those already in the labour force. In other words, labour supply responses are concentrated along the entry margin as well as along the intensive (hours worked) margin.

Moreover, it is undoubted that personal and family characteristics affect the personal decision to supply labour. Married women, tend to be more sensitive to policy changes, regularly varying their decisions of participation in the labour market or hours worked. On the other side, males seem to be less sensitive to changes in the tax-benefit structure, adopting the behaviour of the traditional "male bread winner".

Empirical analysis of labour supply has been a intensive area of research in the last decades, both in United States and in Europe. If before the '80s the prevailing judgements was that taxation was not a serious disincentive to work decision, later academic research changes this opinion. In this sense, a

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[2] Eurostat, Labour Force Survey and Quarterly Labour Force Survey; Reported in European Commission (2005).

fundamental role has been played by the seminal paper of Hausman (1981). Several surveys reported the main techniques and results of the empirical investigations on labour supply, such as Blundell (1988, 1992), Blundell and Macurdy (1999), Atkinson and Mogensen (1993).

The aim of this paper is to estimate the determinants of labour supply for Italian women and men. We use microdata provided by Bank of Italy 2002 survey and adopting a piecewise linear labour supply functional form. Sample selection and Tobit technique have been used. In this analysis demand constraints are ignored. It is therefore assumed that if a person chooses to offer more time on labour market, he is able to do so. Endogenity problems are accounted for using an estimate of real wages instead of reported wages.

Few researches recently treated this issue.

Colombino and Del Boca (1990) estimated a neoclassical household labour supply model for married individuals, incorporating the main elements of the tax system, using a 1979 survey of couples living in Turin. They found that the labour supply of married women is elastic with respect to wage and income variation, while for married men the labour supply is inelastic with respect to variation in both. They estimate a wage elasticity of 0.54 and an income elasticity of –0.22 for married women.

Aaberge et al. (1999) apply an econometric framework which allows for complex non convex budget sets, highly non-linear labour supply curves and imperfect markets with institutional constraints. Using 1987 Bank of Italy microdata they find that male labour supply is fairly inelastic while the

labour supply among females is considerable more elastic. The wage coefficients yelded by their analysis are 0.007 (conditional) and 0.053 (unconditional) for men and 0.078 and 0.737 for women.

The paper is organized as follows. Section 2 presents the main characteristics of the model estimated. Section 3 describes the data used. The tax system is depicted in section 4. Section 5 shows the results and section 6 concludes.

2. *Theory*

A neoclassical labour supply model is here considered. Let's consider an individual whose utility function depends on consumption (C) and hours of leisure (L). The same individual has a budget constraint

$$\sum_{i=1}^{N} P_i Q_i = w(T-L) + E - R(I) \qquad (1)$$

where P_i are the prices and Q_i the quantities of each of the N goods, w is the hourly wage rate, E are the gains from non-work activities, T-L is the number of hours worked and $R(I)$ is the tax paid on the taxable income I.

We assume that all the individual take others household members' labour supply decision as given in making their own decisions. Hence, gains from non-work activities are set as the sum of all the labour and non-labour income of the rest of the household plus unearned personal income.

In the absence of savings, the left-hand side of the equation (1) is equal to the total income of the consumer, Y. Defining the hours worked as $H = T - L$ the preference function becomes:

$$Max \quad U(H,Y) \quad s.t. \quad Y = E + wH - R(I) \qquad (2)$$

In a progressive tax system, we define *R(I)* as a piecewise linear function of taxable income:

$$R(I) = R(I_n) + t_n(I - I_n) \quad (3)$$

n is the index of the tax bracket that the individual faces according to her taxable income *I*, t_n is the tax rate associated with the tax bracket *n*, and I_n is the lower taxable income limit for bracket *n*.

Taxable income differs from gross income because of the value of tax exemptions (*D*):

$$I = wH + E - D \quad (4)$$

Substituting (3) and (4) in the budget constraint (2) we get:

$$Y = (wH + E)(1 - t_n) + t_n D + \left[t_n I_n - R(I_n)\right] \quad (5)$$

That is the linearized budget constraint for bracket *n*.

Splitting the first member of the right-hand side of (5), it is observable that individual behaviour in terms of *H* and *C* is equivalent to that which arises from utility maximization under a linear budget constraint with a relative price of leisure (the uncompensated substitution effect) equal to $w(1 - t_n)$ and a "virtual income" (the income effect) measured by $(1 - t_n)E + t_n D + \left[t_n I_n - R(I_n)\right]$.

For an individual on a given segment, virtual income can be obtained by extending the segment of the budget constraint to the right: the vertical intercept of this line at zero hours of work is the virtual income. In other words, the virtual income is a measure of the earnings of an individual could

in theory enjoy without working, observing her real budget constraint.[3] With this characterization, based on early works on taxes and labour supply (for instance Hall, 1973), we represent a consumer as facing a linear budget constraint in the presence of a non linear tax program.

The indirect utility function that represents preferences is

$$v(w,E) = e^{\beta w}(E + \frac{\alpha}{\beta}w - \frac{\alpha}{\beta^2} + \frac{\gamma+\varepsilon}{\beta}) \tag{6}$$

where α, β are parameters, γ is a parameter linear function of personal characteristics and ε is a random variable. In the hypothesis of no taxes, and then of linear budget constraint, the desired labour supply function is

$$H^*(w,E) = \gamma + \alpha W + \beta E + \varepsilon \tag{7}$$

But the same equation holds also taking into account the non linearity of budget constraint caused by the tax system, replacing gross wage and non-labour income with the relative net wage and virtual income:

$$H^*(w,E) = \gamma + \alpha W(1-t) + \beta V + \eta\Psi + \varepsilon \tag{8}$$

where V is the virtual income. The parameter η takes into account personal and demographic characteristics (Ψ). It is assumed that ε has a mean zero normal distribution in the population.

The wage coefficient and the income coefficient (α and β) being respectively non-negative and non-positive are sufficient conditions for the compensated labour supply wage elasticity to be non negative.

[3] The third term in the virtual income equation represents the difference between the taxes that an individual on segment *n* would pay if she faced a proportional tax with rate t_n and the taxes she actually pays, that is $R(I_n)$.

We assume that observed hours worked are equal to desired hours of work, using a censored sample in which the zero hours observation were included.[4] This choice however is problematic since no wage data were available for those reporting zero hours of work. Moreover, we have no information on whether individuals leave labour force due to search costs or whether are simply discouraged from looking for work expecting their probability of finding a job very small.[5] Heckit technique (Heckman, 1979) was used to correct a possible selection bias as a result of observing only wage rates of those gainfully employed.

In the first step we estimate a probit equation on the whole sample that yields the probability of employment with respect to personal and labour market characteristics

$$P[empl]_i = \omega_i + \delta Z_i^{'} + \mu_i \qquad (9)$$

The realization of P determines whether the individual is employed ($P_i = 1$) or unemployed or out of the labour force ($P_i = 0$). It depends on the vector Z' of personal characteristics. Z' includes data about the non labour income, age and its squared, regional unemployment rate by gender, years of

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[4] Some papers assume that observed hours of work are equal to desired hours of work plus an additive stochastic term of error representing either sample measurement error or the failure of the worker to find a job requiring hours exactly equal to the desired quantity. See for instance Triest (1990).

[5] Duncan (1993) takes into account discouraged workers by estimating a labour supply equation in which he models the desire to enter in the labour force and the employment probability separately from the hours of work decision. This option cannot be followed in this paper because the dataset does not identify discouraged workers.

education and presence of children under 6.

From the probit equation it is possible to create the inverse Mills ratio (or non-selection hazard ratio), used to purge the selection bias derived from the presence in the sample of both workers and non workers.

Let $\Phi(\delta Z_i^{'})$ be the standard normal distribution function evaluated at $\delta Z_i^{'}$.

We have:

$P_i = 1$ with probability $\Phi(\delta Z_i^{'})$ (10)

$P_i = 0$ with probability $1 - \Phi(\delta Z_i^{'})$ (11)

The related normal density function is denoted $\varphi(\delta Z_i^{'})$. Having estimated the probit model, an estimate of the non-selection hazard, $\hat{\lambda}_i$, for a working individual *i* is obtained computing:

$$\hat{\lambda}_i = \frac{\varphi(\hat{\delta} Z_i^{'})}{\Phi(\hat{\delta} Z_i^{'})} \tag{12}$$

In other words, the non-selection hazard gives a measure of the probability of the *i-th* individuals of being included in the sample of the working population.

In the second step, we estimate the wage equation in the sample of working population, including in the estimate the predicted value $\hat{\lambda}_i$, avoiding the problem of selection bias:

$$wage_i = \alpha_i + \beta K_i^{'} + \rho \lambda_i + \varepsilon_i \tag{13}$$

where *K'* is a vector of control variables quite standard that includes age, age squared, years of education and binary variables concerning geographical residence, working categories and the activity sectors.

By imputing the expected value for the yearly labour income in the labour supply model to each observation of the working sample we avoid endogenity caused by the partial dependency of yearly wage on the numbers of hours worked.

In estimating equation (8), an alternative to the use of a censored sample and Heckit technique can consist in using Tobit model, but a problem of this approach is that it does not separate out the individual effect of what determines individuals' likelihood of finding in employment and what determines the hours of work decisions. Tobit model , although used in other research (for instance Heckman and MaCurdy, 1982; Jakubson, 1988) is mispecified when the limit observations (zero hours worked) are the result of personal decisions rather than an exogenous mechanism such as how the data were collected (Maddala, 1988).

However, we estimate labour supply by using both Tobit and sample selection technique.

3. Data

We estimate labour force participation using data from the Survey of Households' Income and Wealth (SHIW), provided by the research division of the Bank of Italy. Data are referred to year 2002.

The database collects information on personal data, geographical characteristics, source of income, savings, consumptions, investments and labour activities from 8,011 households drawn from the lists of 344 towns. The sample is composed of 21,144 individuals and 13,536 of them receive an income (Bank of Italy, 2004).

In order to build a sample useful for a labour supply analysis, we selected individuals aged between 19 and 60 from the database. We drop people under military/civil service as invalids and people retired during the observed year.

The questionnaire does not provide the number of hours worked during the overall year, but only the number of hours worked per week and the number of months worked. To solve this problem we built a proxy for the overall number of hours worked assuming arbitrarily 45 weeks are worked per year (3.75 per month). We therefore drop temporary workers not able to indicate the number of months worked.

The final sample comprises 11,719 individuals. Table 1 shows the main characteristics of the sample. Figures from 1 to 8 in Appendix B show histograms of the frequency distributions of wages and hours worked by category.

We estimate the elasticity of interest by splitting the sample into four different groups according to different gender behaviour on labour market: married women (3,927 observations, 1,723 employed), married men (3,360 observations, 2,752 employed), unmarried women (2,045 and 1,057) and unmarried men (2,387 and 1,385)[6]. The last two categories include people living on their own and all individuals living in a household as sons, daughters or other members or relatives, but not as spouses. Summary

[6] The categories of "married" included both spouses and partners, without distinguishing between the legal status of the two form of household.

statistics show that the two unmarried categories includes younger, better educated people with lower wages.

Since the questionnaire did not provide data about the hourly wage of the workers, we used yearly net labour income. Two reasons led to this choice. The former is that it is difficult to compute an hourly wage for people who do different jobs over the year or at the same time. The latter is that in Italy employees usually negotiate a national contract valid for homogeneous categories of jobs, where the wage is determined on monthly basis and not only exclusively on the number of hours worked.

In the regressions, instead of using binary variables for the different levels of education, we give to each level a number corresponding to the duration of the course[7] and adding the numbers so that the education level is shown by the numbers of years of studying.

[7] We use the following number of years: no education: 0; elementary school: 5; middle school: 3; professional school diploma: 3; high school: 5; short university course degree: 3; bachelor's degree: 4; postgraduate qualification: 3.

Table 1. Main characteristics of the sample

	Married women	Married men	Unmarried women	Unmarried men
whole sample (#)	3,927	3,360	2,045	2,387
age (mean)	44.78	46.37	31.49	29.98
age composition (%)				
age 19-40	33.46	26.64	79.51	86.13
age 41-50	35.55	36.04	11.10	8.34
age 51-60	30.99	37.32	9.49	5.53
Activity (%)				
dependent workers	36.92	62.65	46.16	48.09
independent workers	8.03	22.11	5.48	10.85
other	55.05	15.24	48.32	41.06
Education level (%)				
none	1.74	1.37	0.44	0.75
elementary school	21.11	15.65	4.45	4.48
middle school	34.40	37.23	22.59	30.83
professional school (3 y.)	6.34	7.65	6.75	7.91
high school	27.76	28.66	52.67	46.04
short course univ. degree	0.87	0.63	1.17	0.96
bachelor's degree	7.74	8.57	11.64	8.92
postgraduate qualification	0.05	0.24	0.29	0.08
Residence**(%)				
north	44.05	44.26	40.59	42.94
centre	19.84	19.79	21.03	21.24
south	36.11	35.95	38.39	35.82
worker sample (#)	1,723	2,752	1,057	1,385
Incomes and hours (year)				
mean net wage	13,035.62	18,594.12	12,684.23	13,432.51
mean other income	3,075.16	6,674.03	2,708.33	1,730.77
mean worked hours	1,495	1,825	1,596	1,737

***: Regions in the South are Molise, Campania, Puglia, Basilicata, Calabria, Sicilia, Sardegna. The regions in "Centre" are Toscana, Marche, Umbria, Lazio and Abruzzo. The regions in the North are Liguria, Piemonte, Valle d'Aosta, Lombardia, Veneto, Trentino – Alto Adige, Friuli – Venezia Giulia, Emilia – Romagna.*

4. *The tax system*

In 2002, personal income tax in Italy (IRPEF) consisted of 5 legal tax brackets associated with a piecewise decreasing deduction from gross income. This exemption is computed on the following piecewise equations for dependent workers.

$$\begin{cases} d_l = Y_L \quad if \quad Y_L \le 7{,}500 \\ d_l = 9{,}663.46 - 0.28846 \cdot Y_L \quad if \quad 7{,}500 < Y_L \le 33{,}500 \\ d_l = 0 \quad if \quad Y_L > 33{,}500 \end{cases}$$

And on the following equations for independent workers

$$\begin{cases} d_l = Y_L \quad if \quad Y_L \le 4{,}500 \\ d_l = 5{,}697.39 - 0.19565 \cdot Y_L \quad if \quad 4{,}500 < Y_L \le 30{,}500 \\ d_l = 0 \quad if \quad Y_L > 30{,}500 \end{cases}$$

Moreover, a further deduction is structured as follows:

Table 2. Further deductions on labour income in 2002

Independent worker		Dependent worker	
Income bracket	Deduction	Income bracket	Deduction
< 27,000	0	< 25,000	0
27,000-29,500	130	25,000-29,400	80
29,501 - 36,500	235	29,401 - 31,000	126
36,501 – 41,500	180	31,000 – 32,000	80
41,501 – 46,700	130	> 32,000	0
46,701 – 52,000	25		
> 52,000	0		

The joint action of legal tax rates and deductions provide the implicit tax rates in Table 4. It is noticeable that the fifth bracket presents a tax rate larger than the sixth, for dependent workers, and that the fourth bracket presents a tax rate larger than the fifth, in the case of independent workers. This is a distortion to the progressivity of the system due to the 2002 tax reform and induces non-convexity of the budget sets. For a deeper analysis

of personal income tax reforms in Italy in the period 2002-2005 see Mancini and Tondani (2006).

Table 3. Implicit tax rate on labour income in 2002

Independent worker			Dependent worker		
Tax bracket	Tax rate	Freq. distr.	Tax bracket	Tax rate	Freq. distr.
0 - 7,500	0	13.03	0 - 4,500	0	12.29
7,501 - 19,100	29.63	58.87	4,501 – 17,200	26.98	31.08
19,101 – 30,000	37.37	19.09	17,201-29,200	34.02	27.97
30,001 – 32,900	39.94	1.61	29,201-30,500	36.37	1.30
32,901 – 33,500	50.25	0.24	30,501-32,600	31.00	1.99
33,501 – 70,000	39.00	6.32	32,601 – 70,000	39.00	20.52
> 70,000	45.00	0.83	> 70,000	45.00	4.85

Family tax exemptions for dependent family members are structured as in table 4.

Table 4. Tax deductions for parent in charge

Dependent wife or husband				
Tax brackets	Deduction			
0 - 15,493.71	546,18			
15,493.72 - 30,987.41	496,6			
30,987.42 - 51,645.69	459,42			
>51,645.69	422,23			
Dependent children				
Tax brackets	Deduction			
	1st child	2nd child	3rd child	From the 4th child
0 - 36,151.98	516.46	516.46	516.46	516.46
36,151.99 - 41,316.55	303.68	516.46	516.46	516.46
41,316.56 - 46,481.12	303.68	336.73	516.46	516.46
46,481.13 - 51,645.69	285.08	285.08	285.08	516.46
> 51,645.69	0	0	0	0
If the taxpayer has dependent spouse tax exemption for children is completely attributed to him; otherwise the exemption is attributed to both spouses at 50 per cent per capita				

Since Bank of Italy's dataset provides only net income, we moved backwards in order to get a proxy of gross labour incomes and then compute the virtual income. We subtract the exemption attributable to each worker from him net labour income. From that post-tax income we compute the

gross income using the inverse tax code.

The gross labour income this obtained is only a proxy of this measure because Italian law on personal income taxation allows tax exemption of percentage of expenditure on goods or services such as medical, school or insurance, interests on debt for house purchase, etc. These expenditures are not reported in the database but we consider gross labour income is a close enough approximation of reality.

However, other problems regarding the truthfulness of the data arise from the fact that incomes in the database are declared personally by the head of the household. Several studies on previous SHIW waves analysed this problem. Cannari and Violi (1991) estimate that tax evasion lowers aggregate income by 20 per cent. Cannari and Gavosto (1995) argue that is hard to correct the underestimate of a second income and the overestimate of the hours worked. These problems are caused by the individual's reticence in declaring sensitive data rather than by measuring error, but also by forgetting to declare occasional jobs or calculating holydays and leave. So, although the SHIW database can be considered the most reliable representation of Italian households income and wealth, it may reflect inaccurate figures.

5. Results

The results of the Tobit model are shown in Table 5. The elasticities reported are valid only for local movement along a given budget segment. Married men and married women follow the pattern shown by other researches: in the married population, female labour supply is more reactive

than that of males to an increase in net wage. Unmarried men are more reactive than married men to increase in net wage, while the inverse pattern is observed for women. Income effect is negative and significant in all cases and it is larger for men.

Dummy variables provide other information about labour supply. To be a student negatively affects the number of hours worked, in the unmarried categories. To be divorced decreases labour supply but the coefficient is significant only for men. Presence of children under 6 has negative sign, as expected. Finally, dependent workers present a labour supply smaller than the independents.

Table 5. Tobit estimation of hours worked

hours worked	Married women	Married men	Unmarried women	Unmarried men
net labour income	0.020	0.008	0.011	0.017
	(0.003)**	(0.001)**	(0.003)**	(0.003)**
virtual income	-0.005	-0.003	-0.002	-0.003
	(0.001)**	(0.001)**	(0.001)*	(0.001)**
child under 6	-84.525		-252.417	
	(30.154)**		(126.743)*	
dependent worker	-250.920	-228.484	-160.350	-202.578
	(34.320)**	(19.311)**	(47.921)**	(37.014)**
student			-936.328	-1,227.388
			(124.890)**	(162.623)**
divorced			-58.922	-98.911
			(37.933)	(45.482)*
Constant	1,573.346	1,884.485	1,664.665	1,750.927
	(58.828)**	(31.350)**	(70.691)**	(71.225)**
Standard error	479.478	389.838	432.904	422.840
	(8.168)**	(5.255)**	(9.415)**	(8.034)**
Log likelihood	-13,080.391	-20,322.612	-7,916.353	-10,340.315
Observations	3927	3360	2045	2387

Standard errors in parentheses
* significant at 5%; ** significant at 1%

Since Tobit estimation does not separate out the individuals' probability of being employed and the determinants of hours of work decisions, a second

estimates is made using sample selection approach (Table 6).

Wage and income coefficients are smaller than in the Tobit model. The presence of children under 6 affect negatively and significantly labour supply for both married and unmarried women.

Table 6. Censored sample estimation of hours worked

hours worked	Married women	Married men	Unmarried women	Unmarried men
net labour income	0.026	0.008	0.009	0.013
	(0.004)**	(0.001)**	(0.004)*	(0.004)**
virtual income	-0.006	-0.003	-0.002	-0.003
	(0.001)**	(0.001)**	(0.001)*	(0.001)*
child under 6	-98.653		-238.441	
	(30.954)**		(153.633)	
dependent worker	-224.768	-231.351	-168.170	-219.920
	(41.980)**	(22.612)**	(62.322)**	(41.090)**
student			-815.735	-939.517
			(160.363)**	(164.204)**
divorced			-60.344	-88.220
			(38.938)	(50.200)
inverse Mills ratio	87.368	-40.161	-66.342	-153.095
	(42.253)*	(41.529)	(61.440)	(50.501)**
Constant	1,443.310	1,901.262	1,731.578	1,874.575
	(86.407)**	(38.172)**	(108.996)**	(91.586)**
Observations	1723	2752	1057	1385
R-squared	0.0902	0.0988	0.1063	0.1356
Standard errors in parentheses				
* significant at 5%; ** significant at 1%				

Table 7. Wage and income elasticities evaluated at the means of hours worked

	Married women	Married men	Unmarried women	Unmarried men
Tobit (latent variable)				
Uncompensated wage elasticity	0.203	0.008	0.011	0,017
Income elasticity	-0.003	-0.003	-0.002	-0.003
Compensated wage elasticity	0.206	0.011	0.013	0.020
Sample selection approach				
Uncompensated wage elasticity	0.225	0.084	0.069	0.097
Income elasticity	-0.092	-0.021	-0.024	-0.027
Compensated wage elasticity	0.317	0.105	0.093	0.124

Table 7 shows uncompensated wage elasticity and income elasticity evaluated at the mean of hours worked. For Tobit model elasticities are

conditional on positive hours worked and on the whole sample (unconditional to the censor value).

Negative income elasticities indicate that leisure is a normal good; that is, an increase in income leads to an increase in the consumption of leisure (or a decrease of hours worked).

6. Concluding remarks

In this paper we attempted to estimate the effect of taxes on labour supply for four categories of Italian workers: married men, married women, unmarried men, unmarried women. Using both Tobit technique and sample selection approach we find that in the married population, female labour supply is more reactive than males to an increase in net wage. The positive relationship between the wage rate and the hours of work decision suggests that cuts in income taxes, generating higher after tax wages, would offer an incentive to increase hours of work, even if personal and household characteristics are important in labour supply decision, especially for women. Negative income elasticities indicate that leisure is considered a normal good. Most of these results are consistent with the findings of other research. Nevertheless, two factors affect the coefficients. The first is the non convexity of the budget sets caused by the exemption introduced in the computation of personal income tax. The second is the assumption here adopted of considering hours worked declared equal to hours worked desired. The non specification of the measurement error in the hours worked could lead to some error in the coefficient.

Hence, this investigation left open the possibility of an improvement of the

research in further papers.

Appendix A

Following the econometric methodology explained in section 2 we estimate the probability of being employed. Probit estimates are shown in table 7. All the variables show the expected sign. If not, the coefficient is not significant. In particular, we observe a very small decrease in probability of being employed due to the sum of the household incomes (excluded the wage earned by the individual): a 100,000 euro increase of unearned income produces a decrease in probability of being employed that varies from –0.023 for married men to –0.078 for married and unmarried women. As expected, male probability of being employed decreases less than that of women.

Age and its squared depict an expected and well-known shape of probability: in all four cases, probability of being employed increases with age then decreases. Regressing employment status on age and age squared only, we get that the slope of the probability changes at 38.9 years for married women, 39.8 for married men, 42.4 for unmarried women, 41.1 for unmarried men.

The regional unemployment rate, differentiated for males and females, lowers the probability of employment from –0.035 to –0.094 per cent.

Years of education increase the probability in three cases out of four, with coefficients included in the range 0.009 – 0.126, and the coefficient is significant in three cases out of four. Women's probability is also affected by the presence of children. In the case of unmarried individuals, being a

student plays a negative role in the probability of being employed.

Table A.1. Probit estimates of employment

employed	Married women	Married men	Unmarried women	Unmarried men
other incomes earned by household (x 100,000)	-0.072	-0.023	0.043	-0.068
	(0.000)**	(0.000)**	(0.000)	(0.000)**
child under 6	-0.226		-0.542	
	(0.066)**		(0.274)*	
age	0.172	0.303	0.130	0.167
	(0.024)**	(0.032)**	(0.024)**	(0.022)**
age squared	-0.002	-0.004	-0.002	-0.002
	(0.000)**	(0.000)**	(0.000)**	(0.000)**
unemployment rate	-0.035	-0.046	-0.049	-0.094
	(0.002)**	(0.006)**	(0.003)**	(0.006)**
years of education	0.126	0.094	0.049	0.011
	(0.007)**	(0.008)**	(0.011)**	(0.010)
family size	-0.061	0.158	-0.129	-0.039
	(0.024)*	(0.032)**	(0.032)**	(0.031)
student			-2.318	-2.750
			(0.143)**	(0.168)**
Constant	-3.654	-5.257	-1.324	-1.302
	(0.485)**	(0.676)**	(0.455)**	(0.413)**
Log pseudo-likelihood	-2,213.4817	-1,177.0245	-889.7178	-1,012.3977
Observations	3,927	3,360	2,045	2,387

Robust standard errors in parentheses
* significant at 5%; ** significant at 1%

The Mills ratio produced by this regression was used in estimating wage equations (table 8). Inverse Mills ratio is positive and significant in the cases of married women and men. This indicates that there are unobserved variables increasing the probability of selection and the probability of a higher than average score on the log of the wage. On the other hand, inverse Mills ratio are negative for unmarried categories although the coefficient is not significant.

Table A.2. Wage equations

wage	Married women	Married men	Unmarried women	Unmarried men
age	742.798	1,050.421	189.547	491.165
	(236.432)**	(327.740)**	(234.829)	(162.106)**
age squared	-8.202	-11.580	0.178	-4.312
	(2.912)**	(4.033)**	(3.226)	(2.262)
years of education	785.897	490.067	521.550	144.225
	(143.983)**	(90.101)**	(201.540)**	(73.052)*
Residence. Reference: Regions of the North				
centre	-1,100.481	-1,867.422	-1,043.782	-245.808
	(509.351)*	(531.207)**	(851.233)	(455.296)
south	-3,304.191	-3,839.517	-1,848.952	-1,361.099
	(791.858)**	(461.522)**	(698.060)**	(771.680)
Kind of employment. Reference: blue-collar worker or similar (including apprentices and home workers)				
office worker	1,928.140	2,155.678	518.018	1,899.870
	(416.650)**	(439.564)**	(1,335.692)	(446.424)**
school teacher (in any type of school)	2,038.374	929.831	-866.461	2,682.036
	(658.371)**	(986.040)	(1,749.386)	(1,662.047)
junior manager/cadre	5,673.760	7,780.987	3,474.501	5,660.794
	(1,212.299)**	(928.676)**	(2,097.306)	(1,228.259)**
manager, senior official, principal, headmaster, university teacher, magistrate	15,258.862	20,174.802	12,187.350	19,277.535
	(4,013.742)**	(2,012.623)**	(4,120.306)**	(4,036.112)**
member of the arts or professions	8,387.943	12,639.982	10,578.311	7,739.173
	(1,841.393)**	(2,690.667)**	(4,073.755)**	(1,629.832)**
sole proprietor	5,328.249	13,892.598	8,759.306	11,383.876
	(1,608.450)**	(2,949.735)**	(3,918.272)*	(4,876.880)*
free lance	3,880.711	5,485.094	1,293.686	5,093.440
	(1,573.804)*	(706.794)**	(1,622.033)	(1,134.841)**
owner or member of a family business	7,073.532	4,897.463		5,127.726
	(1,648.624)**	(1,729.114)**		(3,377.469)
active shareholder/partner	4,202.996	8,749.114	269.138	8,129.682
	(2,164.488)	(8,816.991)	(908.169)	(2,396.035)**
Branch of activity of the company in which the member works. Reference: agriculture, hunting, forestry, fishing, fish-farming and related services.				
manufactures	4,323.054	3,466.231	2,932.813	3,206.664
	(989.190)**	(830.015)**	(1,010.932)**	(858.294)**
building and construction	2,520.742	2,521.932	2,745.176	2,675.024
	(2,558.668)	(951.588)**	(2,205.676)	(956.821)**
wholesale and retail trade	1,944.189	844.148	2,262.119	2,995.129
	(1,123.325)	(922.935)	(995.522)*	(1,009.353)**
transport, warehouse and storage and communication services	2,614.269	3,817.789	3,264.321	3,442.184
	(1,407.421)	(977.720)**	(1,694.879)	(1,087.005)**

real estate and renting services, IT services, research	1,570.782	2,301.467	3,688.114	2,065.003
	(1,235.406)	(1,632.712)	(2,608.838)	(1,369.550)
domestic services provided to households and other private services	844.827	940.440	183.984	1,077.299
	(962.780)	(1,427.120)	(1,020.889)	(1,384.143)
general government, defence, education, health and other public services	3,348.713	2,231.234	2,641.801	2,384.505
	(960.874)**	(895.657)*	(1,018.417)**	(952.469)*
extraterritorial organizations and entities	6,195.639	5,764.831		-276.534
	(3,135.469)*	(4,405.506)		(2,297.750)
services of credit and insurance institutions	4,586.671	11,341.410	6,521.211	5,030.569
	(1,401.591)**	(3,378.641)**	(3,355.120)	(1,571.861)**
Mills	5,105.836	5,978.343	-2,712.574	-600.761
	(1,534.691)**	(1,982.249)**	(1,203.971)*	(1,102.491)
Constant	-19,727.565	-15,598.887	-1,834.495	-3,092.275
	(6,654.247)**	(7,006.027)*	(4,340.625)	(3,162.614)
Observations	1723	2752	1057	1385
R-squared	0.2255	0.2698	0.1953	0.2694
Robust standard errors in parentheses * significant at 5%; ** significant at 1%				

Appendix B

Figure 1 - Frequency distribution of wage by married women

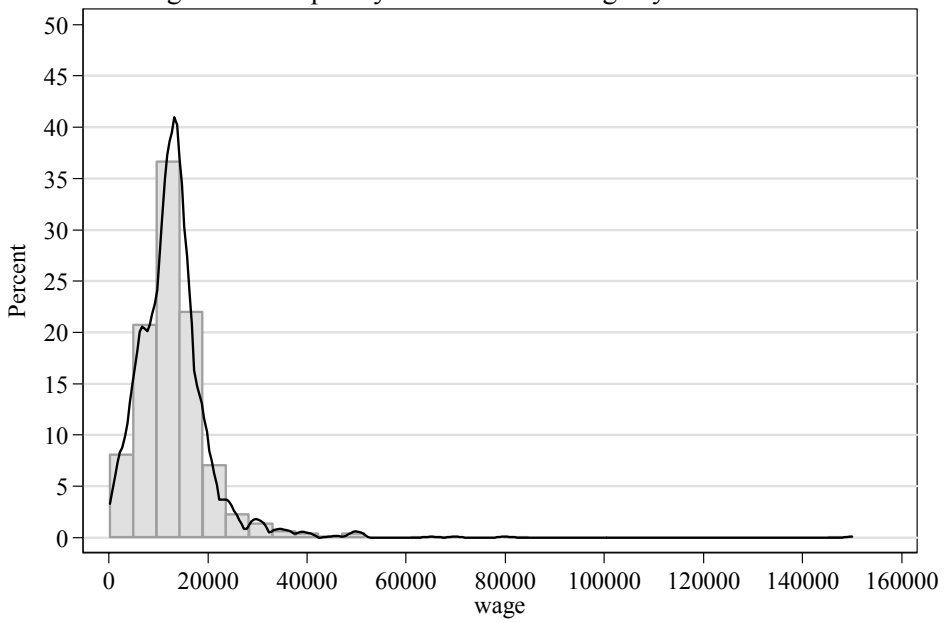


Figure 2 - Frequency distribution of wage by married men

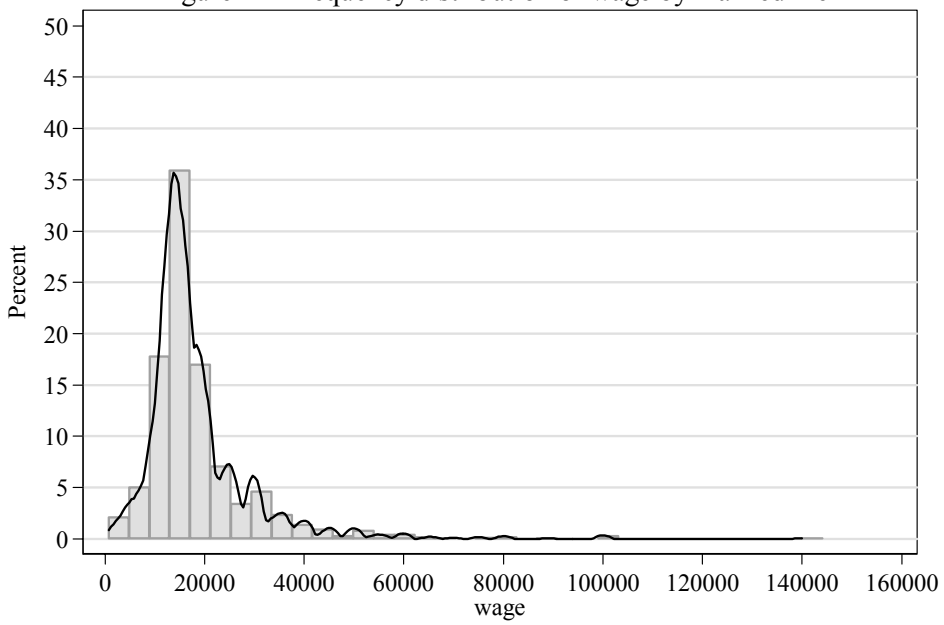


Figure 3 - Frequency distribution of wage by unmarried women

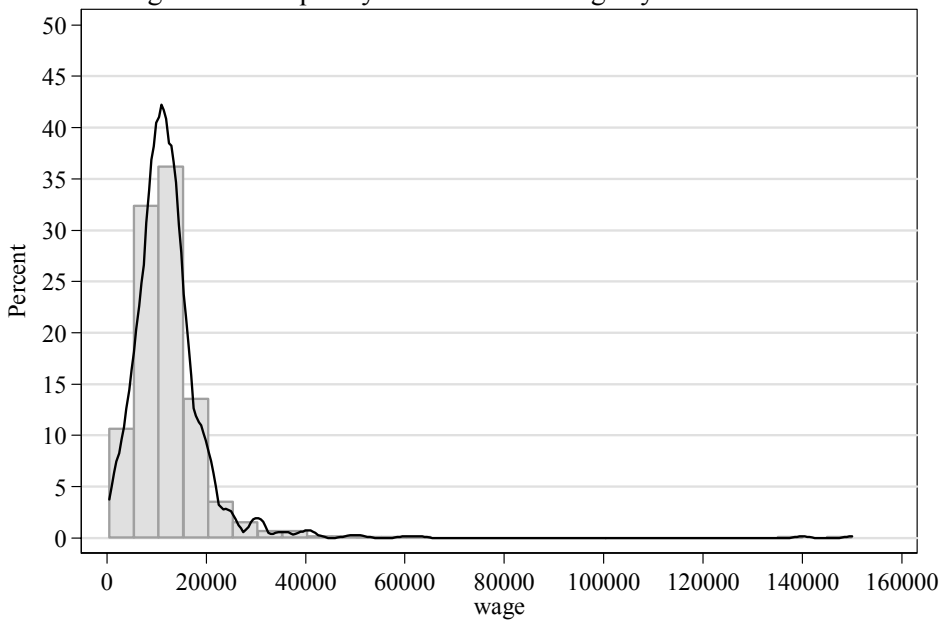


Figure 4 - Frequency distribution of wage by unmarried men

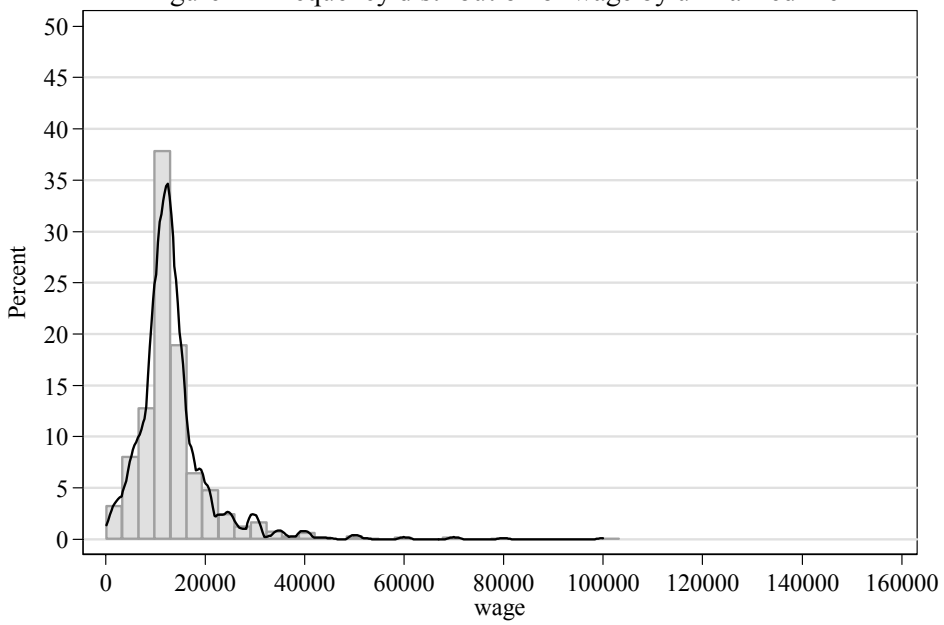


Figure 5 - Frequency distribution of hours worked by married women

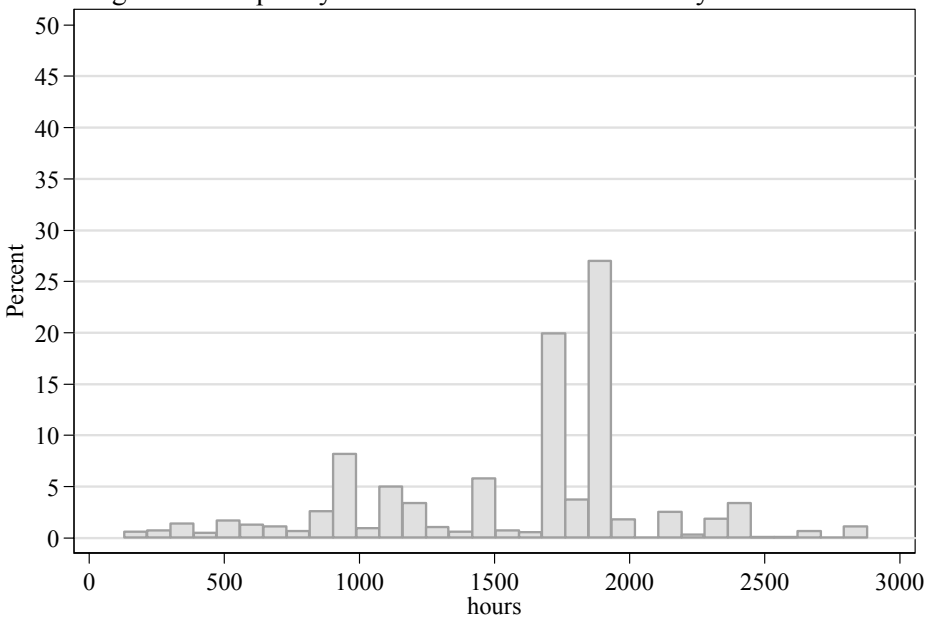


Figure 6 - Frequency distribution of hours worked by married men

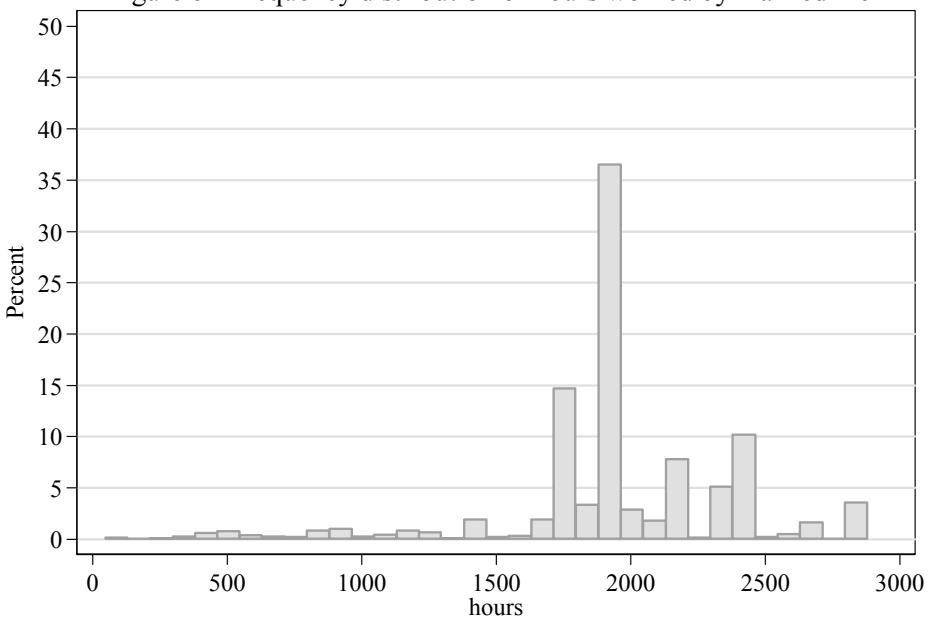


Figure 7 - Frequency distribution of hours worked by unmarried women

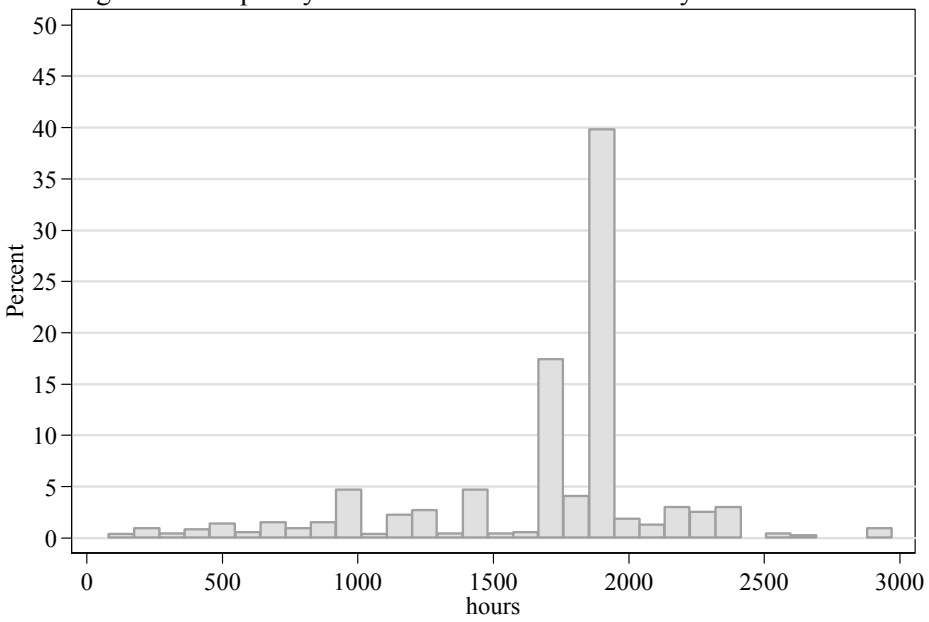
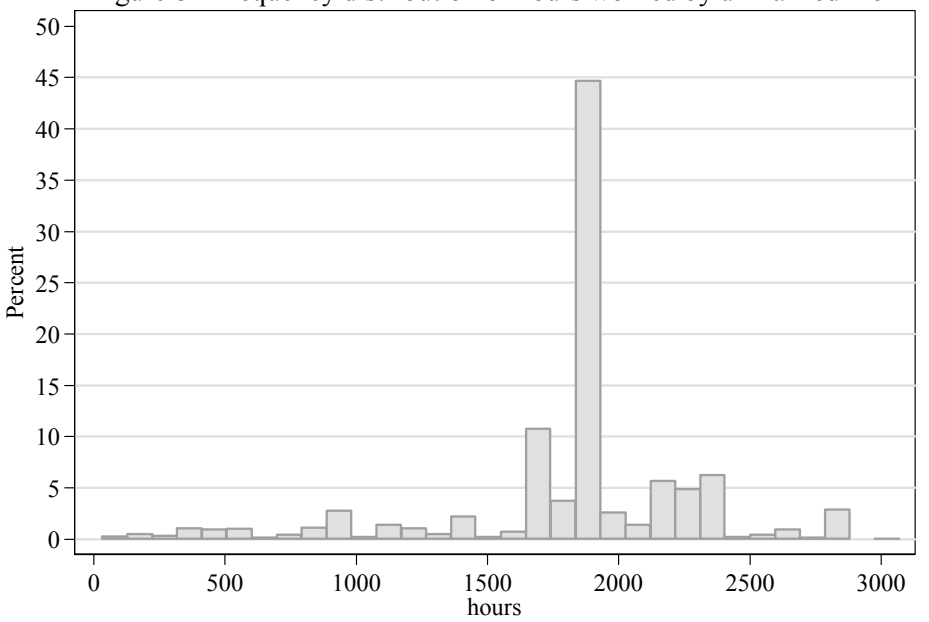


Figure 8 - Frequency distribution of hours worked by unmarried men



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